

COMPRESSED AIR TREATMENT DEVICE THAT IS DESIGNED TO BE  
INSTALLED IN AN INDUSTRIAL VEHICLE

Technical field

The invention relates to the technical field of  
5 electropneumatic components particularly those used in  
industrial vehicles such as trucks or the like. It  
relates more specifically to a compressed-air treatment  
device which combines both the supply of the main  
braking system or service brake, with the supply of the  
10 various other systems that employ compressed air as a  
source of power.

Prior art

In general, industrial vehicles, particularly trucks,  
15 are equipped with a braking system that operates on  
compressed air. This compressed air is produced by a  
pneumatic compressor driven by the engine. This  
compressor delivers compressed air which is stored in  
an air reservoir intended to supply the service brake  
20 circuit. In that way, when the driver operates the  
brake pedal, the compressed air contained in the  
reservoir concerned supplies the pneumatic circuit thus  
braking the motor vehicle.

25 The same arrangement is used for the service braking of  
the trailer, when the latter is connected to the motor  
vehicle. An additional reservoir, dedicated to the  
trailer service braking circuit is also supplied via  
the compressor.

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More specifically, the compressed air produced by the  
compressor and bound for the reservoirs is routed via  
an electropneumatic device. This device, connected to  
the outlet of the compressor, treats the air thus  
35 produced to deliver it in an optimum way to the  
reservoirs connected to the service braking circuit.

This treatment device also delivers compressed air bound for other systems carrying out various functions within the vehicle.

5 Mention may in particular be made of the parking brake system, which allows the vehicle to be immobilized when it is at rest, by mechanically locking the wheels. This parking brake is released by an actuator when the latter is supplied with compressed air at an  
10 appropriate pressure. On existing vehicles, the air treatment device situated at the outlet side of the pneumatic compressor therefore delivers a supply pressure which is conveyed, via dedicated lines, up near to the actuators used to release the parking  
15 brake.

More specifically, these lines supply pneumatic components, such as cocks and valves in particular, which deliver a suitable pressure to the actuator.  
20 These cocks are generally operated manually by the driver.

Hence, the air treatment device situated on the outlet side of the compressor has an air outlet dedicated to  
25 supplying the parking brake circuit of the motor vehicle.

Examples of such treatment devices are described in particular in documents EP 0 689 117, EP 1 004 495,  
30 WO 96/34785, EP 0 831 383, EP 0 864 476 and WO 00/07863.

Such devices also comprise supplementary compressed-air outlets intended to supply other systems operating on  
35 compressed air.

Mention may for example be made of the pneumatic suspension devices for the axles. For this, the air treatment device situated on the outlet side of the

compressor comprises an air outlet which supplies a set of electrically operated valves arranged near the pneumatically suspended axles. These electrically operated valves are operated on the basis of

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5 information from sensors situated near the suspended axle.

An altitude sensor measures the difference in height between the chassis of the vehicle and the axle  
10 concerned. This sensor delivers information which is processed in order to operate the electrically operated valves that supply the pneumatic suspension cushions, on the basis of the pressure delivered by the air treatment device connected to the compressor.

15 The same arrangement is also used for managing the parking brake mounted on the trailer.

The same kind of architecture is also used for various  
20 other auxiliary equipment items, among which particular mention may be made of the movement take-offs, or alternatively the differential lock systems.

It will be appreciated that the existing architectures  
25 have the disadvantage of a localized installation of the various components used for each of the functions described hereinabove. The dispersion of these various components and the proliferation of the pneumatic connections, particularly for connection with the  
30 chassis and the cab of the motor vehicle, generate numerous risks of leakage and of improper contacts, together with problems of installation and of maintenance.

35 One of the problems that the invention proposes to solve is that of the complexity of the pneumatic circuit and its control circuit.

Summary of the invention

The invention therefore relates to a device for treating compressed air, intended to be installed in an industrial vehicle. Such a vehicle is generally made up

- 5 of a motor vehicle that is able to haul a trailer. The air treatment device comprises, in the known way:
- an air inlet for air coming from a compressed-air source;
  - at least one air outlet connected to a reservoir  
10 intended to supply the service brake system;
  - a set of electropneumatic components distributing compressed air from the compressed-air source bound for the reservoir or reservoirs;
  - an electronic command and control unit, able to  
15 operate said set of electropneumatic components, this control unit being connected to a computer communication bus.

According to the invention, this device is  
20 characterized in that it also comprises:

- . a supplementary air outlet intended to supply the actuator or actuators of the motor vehicle parking brake system;
- . a supplementary set of electropneumatic components  
25 which are associated with the supplementary air outlet;
- . operating means incorporated into the electronic command and control unit, able to operate the supplementary set of electropneumatic components on  
30 the basis of information originating from the computer communication bus and/or sensors connected directly to the command and control unit.

In other words, the parking brake is operated directly  
35 by the air treatment device situated on the outlet side of the compressor, rather than by a special-purpose functional assembly which would be dispersed to various points on the vehicle. Operation of the parking brake is to be understood as meaning not only the supplying

of the actuators with compressed air pressure, but also the taking account of specific information that allows or forbids the release of the parking brake, on the basis of numerous items of information originating in

5 particular from the cab of the vehicle.

Thus, the various electropneumatic components such as the electrically operated valves that supply the parking brake actuator are incorporated into the air  
10 treatment device situated on the outlet side of the compressor and are no longer as they were in the prior art, spread throughout the vehicle.

One of the aspects of the invention therefore consists,  
15 on the one hand, in grouping together within one and the same air treatment device, the various electropneumatic components responsible for releasing the parking brake and, on the other hand, in incorporating the control logic for these components  
20 into the command and control unit.

The reliability of the whole is thus improved because there is no longer any need to convey to various points of the vehicle and especially to the cabin, the  
25 pneumatic information for operating the valves responsible for the parking brake function. The maintenance operations are thus made easier, as are the possibilities of carrying out automated diagnostics, using overall management of the command and control  
30 unit, which operates this parking brake.

According to another feature of the invention, the supplementary air outlet and the set of associated electropneumatic components, can be arranged in an  
35 element attached to the body of the device. In other words, the supplementary air outlet supplying the actuators of the parking brake system is incorporated into a particular segment which is attached by flanges to the main body of the air treatment device. This

architectures proves to be particularly advantageous because it allows the air treatment device to be built up in a modular way, with the possibility in particular of replacing only this segment when it becomes  
5 defective, or alternatively of fitting onto a common body various segments configured to supply various types of actuator in the parking brake system.

According to another feature of the invention, the air  
10 treatment device may also be designed to operate a pneumatic suspension system. In this case, the air treatment device also comprises:

- at least one supplementary air outlet intended to supply the actuator or actuators of the pneumatic  
15 suspension system of one axle;
- an additional set of electropneumatic members, which is associated with the supplementary air outlet or outlets;
- operating means incorporated into the electronic  
20 command and control unit and able to operate the additional set of electropneumatic members on the basis of information originating from the computer communication bus.

25 In other words, the air treatment device connected to the compressor has electrically operated valves which directly supply the pneumatic suspension cushions by delivering the right pressure and flow rate for optimum operation of each of these cushions.

30 These electrically operated valves are operated on the basis in particular of information flowing along the computer communication bus and/or originating from sensors dedicated to the function, particularly one or  
35 several altitude sensors measuring the difference in height between the chassis of the vehicle and one or several points on the pneumatically suspended axle.

Thus, the altitude information is conveyed from near the axle to the electronic command and control unit. It is the latter that then determines the pressure and flow rate that needs to be sent to the pneumatic suspension cushions and which operates the appropriate electrically operated valves, these valves being incorporated into the air treatment device characteristic of the invention.

10 In this way, the electropneumatic components involved in managing the parking brake are gathered together at one single place within the air treatment device connected to the compressor, making maintenance operations easier and bringing uniformity to the  
15 command and control logic.

This architecture may be broken down to suit the extremely numerous scenarios as far as pneumatic suspension circuits are concerned. Specifically, the  
20 vehicle may have one or several pneumatically suspended axles. On each axle, the various pneumatic cushions may be supplied by the same pressure source or alternatively by two different pressure sources. Added to the cushions that provide pneumatic suspension  
25 proper, there may be one or more supplementary cushions used for raising an axle.

Thus, the air treatment device according to the invention has the number of outlets suited to the  
30 operation of all the suspension cushions present on the vehicle.

Because all of the controls for the various electropneumatic components are incorporated into one  
35 and the same device, the supervision of the pneumatic suspension system as a whole is improved, and diagnostic and maintenance operations are made easier.

According to another feature of the invention, the supplementary air outlet or outlets intended to supply the pneumatic suspension system, and the set of associated pneumatic members, are gathered together  
5 into one or several elements attached by flanges to the body of the air treatment device.

It is thus possible to alter the architecture of the air treatment device to suit the layout of the  
10 vehicle's pneumatic suspension, by combining one or more modules each of which comprises outlets for supplying the air cushions.

Advantageously, in practice, the air outlets intended  
15 for supplying the pneumatic suspension system which are attached to an axle can be grouped together in the same element attached by flanges to the body of the device. In other words, the air treatment device comprises several segments attached to the main body, and each  
20 one responsible for supplying the pneumatic suspension cushions of a particular axle.

According to another feature of the invention, the air treatment device may be improved to operate various  
25 other systems employing compressed air. In this case, the device then comprises at least one complementary air outlet intended to supply the pneumatic actuator or actuators of an auxiliary system such as, in particular, a differential lock system or alternatively  
30 a movement take-off system or any other system requiring the use of pneumatic power.

This device also comprises a complementary set of electropneumatic members which is associated with these  
35 complementary air outlets. The operating means incorporated into the electronic command and control unit are able to operate this complementary set of electropneumatic members on the basis of information flowing along the computer communication bus and/or

originating from sensors dedicated to the various functions.

5 According to another feature of the invention, the device may also comprise means for dehumidifying the air originating from the compressed-air source. These dehumidifying means may for example include cartridges that can be removed from the body of the air treatment device.

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According to another feature of the invention, the treatment device may also comprise one or several supplementary elements attached to the body of the device. Each of these elements may have one or several  
15 electrical contacts able to be incorporated into an electric control circuit.

These relay contacts are operated via the command and control unit on the basis of information from the  
20 computer communication bus and/or dedicated sensors. By virtue of these electrical contacts it thus becomes possible to operate electrically operated systems. Mention may be made, by way of example, of the control of a differential lock system, which may be performed  
25 electrically, or alternatively the power take-off systems, activation of which may, in some cases, be brought about solely under electrical power.

Mention may also be made of the parking brake systems,  
30 the actuators of which are operated electrically, rather than pneumatically. Thus, management of this parking brake, whether it be on the motor vehicle or on the trailer, is performed via the command and control unit mounted on the air treatment device. This command  
35 and control unit operates the electrical contacts included within the appropriate module thus allowing the electric actuator of the parking brake to be powered or otherwise.

Brief description of the figures

The way of producing the invention and the ensuing advantages will become clearly apparent from the description of the embodiment which follows, given by  
5 way of nonlimiting example with support of the appended figures, in which:

Figure 1 is an outline perspective view of an air treatment device according to the invention.

Figure 2 is a front view of the device of figure 1.

10 Figure 3 is a simplified functional diagram showing the overall operation of the device according to the invention.

Embodiment of the invention

15 As already mentioned, the invention relates to an air treatment device intended to equip industrial vehicles such as trucks in particular.

In one particular embodiment, this device is in the  
20 form illustrated in figure 1. Thus, in general, the air treatment device (1) comprises a main body (2) equipped with an air inlet (3) which is intended to be connected to the compressor, itself driven by the engine. The body (2) also comprises a plurality of air outlets (4)  
25 intended in particular to supply the front and rear service braking circuits of the motor vehicle, and certain other devices operating on compressed air such as the clutch assistance systems for example, on automatic transmissions.

30 The number of air outlets (4) illustrated in figure 1 is given by way of example, it being understood that the invention covers alternative forms in which the number of outlets is lower or higher than the number  
35 illustrated.

The body (2) also accommodates an air dehumidifying cartridge (5) able to remove some of the moisture of the air coming from the compressor. This cartridge (5)

may be replaced by other equivalent devices, particularly those employing membranes, and which may possibly be incorporated directly into the body (2) of the air treatment device. Under its underside, the body  
5 (2) has an exhaust silencer (6) that has no particular impact on the essential features of the invention.

On its front face, the body (2) has a command and control unit (10) which, as described later on,  
10 operates the various electropneumatic components included within the device. This command and control unit (10) is equipped with a connector (11) which, amongst other things, makes the connection with a computer communication bus allowing communication with  
15 various members mounted on the vehicle, particularly the operating and display members present in the cab of the vehicle.

On the opposite side to the air inlet (3), the body of  
20 the treatment device comprises a plurality of modules (13-18) which are attached to the body (2) of the device, and more specifically above and below an intermediate portion (20) connected to a lateral face of the body (2). More specifically, these various  
25 modules (13-18) may vary in number according to the configuration of the vehicle pneumatic circuit, and according to the number of pneumatic actuators to be supplied.

30 According to the invention, some of these modules (13-16) include electropneumatic members, and typically electrically operated valves. Certain other ones of these modules (17, 18) are equipped with electromechanical and/or electronic components,  
35 typically relays. The supply of compressed air to these various modules (13-16) is via ducts (21, 22) hollowed out inside the intermediate portion (20). These ducts (21, 22) pass along inside the intermediate portion (20) and open out at appropriate points so as to take

the corresponding openings made in the pneumatic modules.

When locations likely to accommodate modules are not  
5 occupied, these ducts hollowed out in the intermediate portion are then plugged using appropriate members, to prevent any air leaks.

In the same way, the electrical supply to the various  
10 modules, particularly the supply to the electrically operated valves and relay controls, is via electrical bundles (25) which are routed along inside the intermediate portion and open onto the faces facing the modules. Suitable connections allow the electrical  
15 signals to be carried along inside the modules to operate the electropneumatic, electromechanical or electronic members. These electrical bundles (25) therefore allow the various control signals to be carried from the command and control unit (10) to the  
20 various modules (13-18). This bundle may, for example, be produced in the form of a printed circuit incorporated within the intermediate portion (20). Connection members are then fitted in order to connect the tracks of this printed circuit to the upper and  
25 lower faces of the intermediate portion.

Each electropneumatic module comprises an air outlet consisting of a pneumatic connector (26) connected to the outlet of the electrically operated valve that is  
30 contained in the module (16). In the same way, each electromechanical module comprises an electric connector (28) for leading out the electrical contacts for the relay or relays contained in the electromechanical module (18).

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As illustrated in figure 3, the electronic command and control unit (10) is connected via the connector (11) to a computer communication bus (30) with which the vehicle is equipped. This bus (30) may in particular be

connected to an electronic unit (31) situated in the cab and itself interfaced with the various switches or potentiometers on which the driver acts, via levers, push-buttons, rotary switches or some other pedal.

5

This computer communication bus (30) is also connected to the control unit (32) which provides displays on the instrument panel in the cab. This control unit (32) therefore in particular is concerned with displaying  
10 the various warning lamps advising of the operating status of the functional members of the vehicle and various failure or configuration messages.

This communication bus (30) may also be interfaced with  
15 other members or systems present in the vehicle. It may for example be a device (33) allowing the pneumatic suspension system to be controlled remotely or alternatively various distinct systems of the air treatment device, for sharing with the latter  
20 information of the same nature, originating from sensors themselves connected to one of these systems. It may for example concern information about the speed of the road wheels of the vehicle, originating from the sensors connected to the device for electronically  
25 regulating the service braking.

More specifically, and with reference to figure 3, the heart (37) of the body (2) of the air treatment device comprises known electropneumatic members which will not  
30 be described further in detail.

These members generally regulate the pressure delivered by the compressor (7), with possible exhausting when the air consumption is insufficient, or even with  
35 interaction with the compressor itself through the opening of its intake and exhaust valves.

These members also distribute the air produced, bound for the reservoirs of the front and rear service

braking circuits of the motor vehicle, and for the service braking circuit reservoir of any trailer there might be. This air passes, as soon as it leaves the compressor, through a desiccator the essential part of which is formed by the cartridge (5) illustrated in the figures.

According to the invention, the air treatment device manages the parking brake of the motor vehicle. More specifically, one of the electropneumatic modules (16) is dedicated to supplying the parking brake of the motor vehicle. This module (16) delivers a pressure which acts on an actuator which opposes the application of the parking brake. It is in the presence of this pressure that the parking brake is released. In other words, when this pressure is absent, the parking brake cannot be released. The pressure thus delivered by this module (16) is so by way of an electrically operated valve (27) which is operated on the basis of various information items processed by the command and control unit (10).

Various processing operations on this information may be carried out according to particular safety modes. Thus, the authorization to release the parking brake may be determined on the basis of the command given by the manipulator actuated by the driver, and a measure of the pressure in the service brake circuit reservoir. This pressure check makes it possible to avoid releasing the parking brake when the service brake is not yet operational, because the pressure in the service braking circuit is not yet sufficient. The command and control unit (10) therefore checks these various conditions and governs the electrically operated valve accordingly.

According to another type of parking brake management system, one particularly in force in the countries of Northern Europe, a check is also made to ensure that

the driver is present in the cab before authorizing the release of the parking brake. Detection of the presence of the driver can be done in various ways, either by detecting his presence using a sensor present under his seat, or alternatively by detecting actuation by the driver of a particular pedal or lever. It is by combining these various conditions that the electronic command and control unit governs the electrically operated valve of the module that releases the parking brake.

Other functions may also be performed in relation to the parking brake, by virtue of the incorporation of its control into the air treatment device. This may for example be automatic engagement of the parking brake when the driver switches off the ignition in his cab. It is also possible, for example by using a tilt sensor, to make an automatic transition from the service brake to the parking brake when stopping on a hill, also making use of certain information (vehicle speed, etc.) flowing along the computer communication bus.

In certain types of vehicle, it may prove advantageous to use an actuator associated with certain functions, that can be operated electrically. The application of power to this particular actuator may be achieved by way of an electromechanical or electronic module (17, 18) mounted on the air treatment device. In this case, the module may in particular contain a relay (38) a contact of which is inserted in the power circuit for this particular actuator. The appropriate control of this relay (38) powers this circuit, when this application of power is authorized by the electronic command and control unit (10).

According to another feature of the invention, one or several modules (13-18) of the air treatment device are dedicated to the operation of the pneumatic suspension

system. In general, the pneumatic suspension systems comprise one (or several) pneumatic cushions which are supplied with appropriate pressures and flow rates, themselves delivered by electrically operated valves.

5 Each electrically operated valve is supplied on the basis of the altitude set point corresponding to the desired distance separating the chassis from the suspended axle. The electrically operated valve is therefore operated on the basis of this set point and

10 of the information originating from the altitude sensor (34) present at the axle concerned. This information may pass along the computer communication bus or, more generally, may pass along a specific wired connection (35). This altitude sensor may also be associated with

15 a sensor indicating the pressure within the pneumatic cushion to allow optimum operation together with complementary functionalities such as measuring the load on the axle.

20 The number of modules dedicated to supplying the suspension system may vary, according to the suspension architecture chosen. Thus, depending on whether the axle is situated at the trailer attachment or whether the axle is situated at some other point, the cushions

25 present on the axle may be supplied either in parallel or independently. The suspension cushions may also be associated with a lifting cushion allowing the axle to be raised and brought closer to the chassis. This reconfiguration may take place on the basis of a

30 comparison between the load measured on each axle and the maximum load authorized per axle. Thus, a pressure sensor arranged at the axle, measuring the load on the axle may be interfaced with the electronic command and control unit (10) and automatically cause the lowering

35 of the raisable axle if this pressure exceeds a predetermined threshold corresponding to the maximum authorized load.

According to the invention, the electropneumatic modules (13-16) may also supply other members generally known as "auxiliaries" and operating on compressed air power. This may relate to devices generally known as

5 "utilities" and which operate with special-purpose devices that require supply of a predetermined pressure and a predetermined flow rate. Mention may for example be made of the assistance systems present in the transmission.

10

It may also relate to movement take-offs or power take-offs, corresponding to a mechanical output, generally taken off the transmission or taken directly off the engine. The rotational movement may, for example, be  
15 converted into hydraulic power to power hydraulic rams of a skip, crane or equivalent system.

Among the auxiliary devices mention may also be made of differential lock systems. Thus, an outlet from an  
20 electropneumatic module may act on an actuator which itself acts on an automatic member at the differential considered, which may be a differential between wheels, a differential between axles, or alternatively may be the transfer gearbox.

25

More generally, this invention may relate to any system of the vehicle that habitually uses pneumatic power (except for the service braking), for example the pneumatic air horns or certain bodywork equipment  
30 items.

The use of the electronic command and control unit (10) centralized into the air treatment device (1) according to the invention provides automated control of these  
35 various auxiliary functionalities. Mention may for example be made of the antiskid function which may require automatic locking up of the differential and which, through appropriate interfacing via the computer

communication bus, allows this function to be carried out very simply by virtue of the invention.

It is evident from the foregoing that the air treatment  
5 device according to the invention has numerous advantages, particularly:

- an improvement in the reliability and a reduction in the air leaks by reducing the number of components and pneumatic connections used in using the pneumatic  
10 power;
- an improvement in safety associated with the possibilities of diagnosing and managing the degraded modes of the pneumatic circuit;
- an improvement in the options for managing the  
15 auxiliary functions by virtue of the use of a command and control unit centralized to the air treatment device;
- a reduction in the cost of the system by virtue of the modular architecture of the air treatment device;
- 20 • ease of evolution and of customization of this system to suit a different range of vehicles.